

What's the difference between a physical property and a chemical property?  
What is the difference between a physical change and a chemical change?




---

### The Model


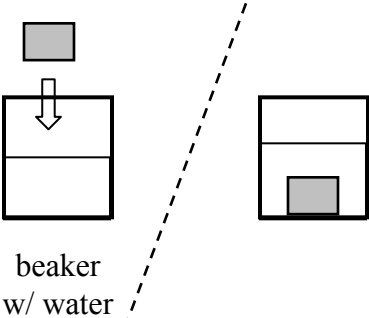

(Reference: section 1.1 in *Silberberg 5<sup>th</sup> ed.*)

Substances are known by their *physical properties* and *chemical properties*.


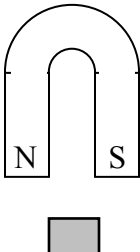

**Example 1:** Mass is a *physical property*

Before the property is measured	Measuring the property	After the property is measured
 block of aluminum		 block of aluminum $m = 307 \text{ g}$

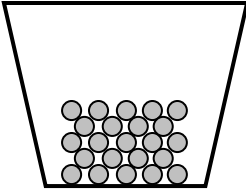
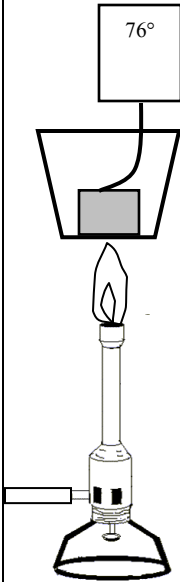
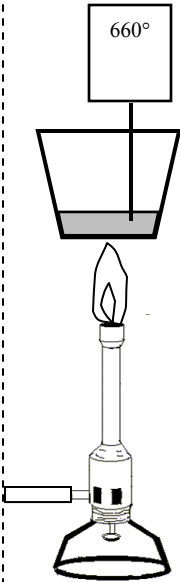
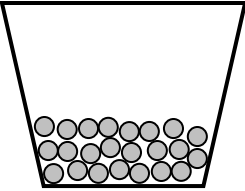
**Example 2:** Volume is a *physical property*

Before the property is measured	Measuring the property	After the property is measured
 block of aluminum		 block of aluminum $V = 114 \text{ mL}$

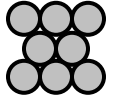
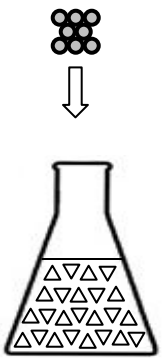
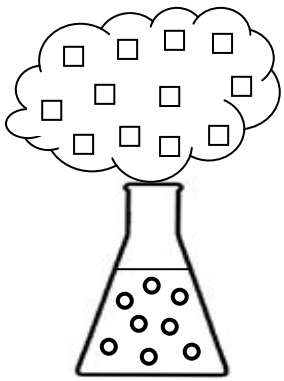
**Example 3:** Magnetism is a *physical property*

Before the property is measured	Measuring the property	After the property is measured
 block of aluminum		 block of aluminum Not magnetic

**Example 4:** Melting point is a *physical property* associated with a *physical change*

Before the property is measured	Measuring the property		After the property is measured
 block of aluminum in a crucible			 liquid aluminum in a crucible $T_f = 660\text{ }^{\circ}\text{C}$ (This is a freeze frame. The particles are in motion.)

**Example 5:** Reactivity is a *chemical property* associated with a chemical change

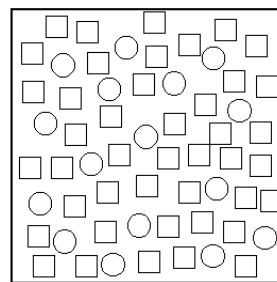
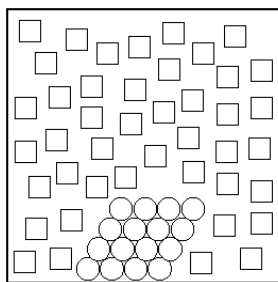
Before the property is measured	Measuring the property	After the property is measured
 block of aluminum	 flask w/ acidic solution	 hydrogen gas and flask w/ solution of aluminum ions

## Key Questions

1. Make a list of the **physical properties** that are identified in the Model.
2. What are the common characteristic features of **physical properties** represented in the Model (aside from the fact that they all involve aluminum)?
3. According to the Model, how does the **chemical property** differ from the **physical properties**?
4. The process in Example 2 in the Model also illustrates a **chemical property** of aluminum. Explain how. (*Hint*: In what way does aluminum react or not react?)
5. Below is a representation of the **solvation** process (*e.g.*, water dissolving a sugar crystal):

Before dissolved

(○ = solute particle in crystal and □ = solvent particle, which is moving.)



After dissolved

(All particles are moving.)

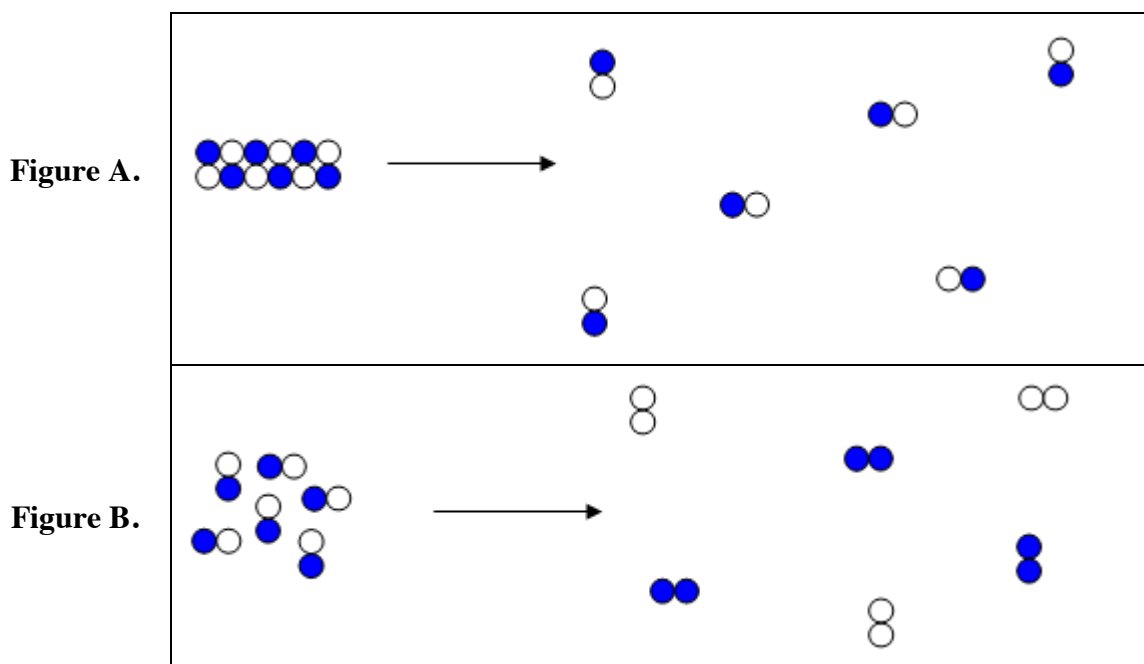
Is the ability of one compound dissolving into another a **physical property** or a **chemical property**? Explain. (*Hint*: Carefully look at the geometric shapes used in Example 5 of the Model. Then look at the above figures. Do the shapes of the particles change or remain the same? What does this imply?)

6. What is **density** defined as? Is density a **physical property** or a **chemical property**? Explain.

## Exercises

7. Which of the following statements about phosphorous describe **physical properties**? Which describe **chemical properties**? Briefly explain your choice.
- a.) Phosphorous is never found free in nature. For example, phosphorous catches fire spontaneously in air.
  - b.) Phosphorous melts at 44.1 °C.
  - c.) Phosphorous can be stored under water.
  - d.) Phosphorous dissolves in carbon disulfide.
8. As was done in Example 4 in the Model, sketch a representation (with “before”, “during”, and “after” the property is measured) of how the boiling point of a liquid might be determined. Is the **boiling point** of a substance a **physical property** or a **chemical property**? Explain.
9. Use what you have learned about chemical and physical changes to identify the type of change that occurs in each of the following. Briefly explain your reasoning in each case.
- a.) Digestion of food within an animal’s digestive system: Physical or Chemical change? (circle one!)
  - b.) The yellowing of the pages of an old book: Physical or Chemical change? (circle one!)
  - c.) The evaporation of perfume from an open bottle: Physical or Chemical change? (circle one!)
  - d.) The healing of a cut finger: Physical or Chemical change? (circle one!)

10. The following two figures represent changes in matter at the atomic scale.



Answer the following questions and *briefly explain your reasoning in each case.*

- Which figure(s) represents a *physical change*?
- Which figure(s) represents a *chemical change*?
- Which results in substances with different *physical properties*?
- Which results in substances with different *chemical properties*?
- Which results in a *change in state*?
- Identify the states of matter present in each figure.

	Physical State of Reactants	Physical State of Products
Figure A		
Figure B		